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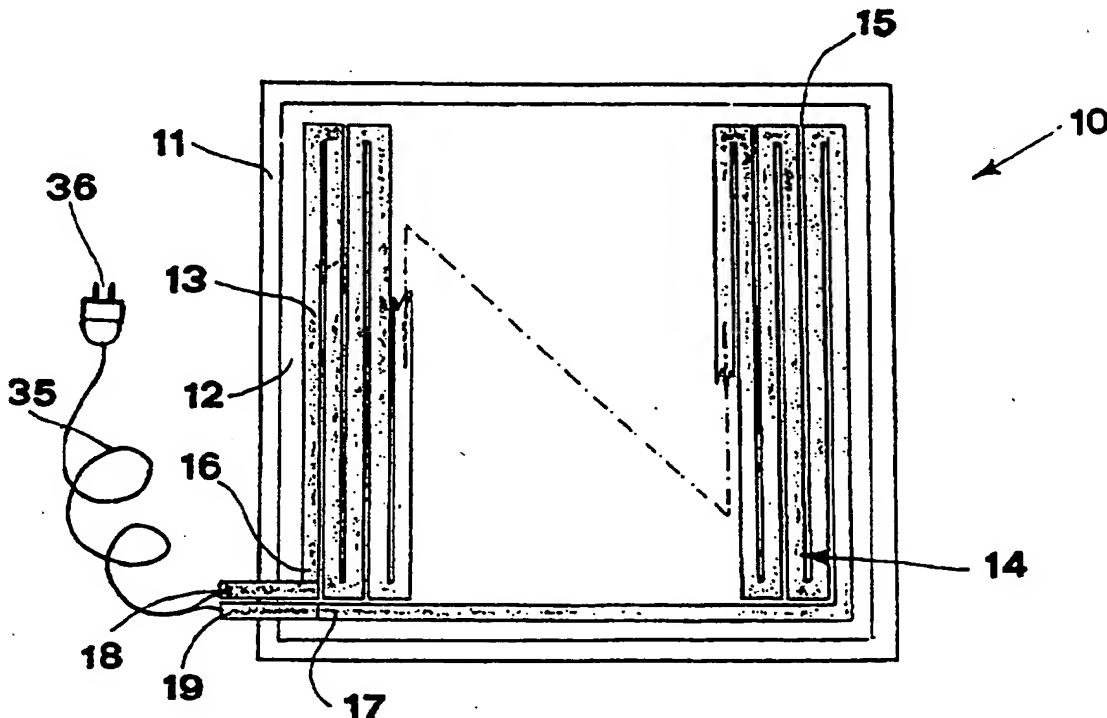
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(54) Title: ELECTRICAL HEATING DEVICE



(57) Abstract

Apparatus (10) for transforming electric current into heat and for diffusing said heat, consisting of one or more continuous strips (13) of highly conductive material, of constant width, whose thickness is measurable in microns, with a high ratio between width and thickness, arranged in the form of a serpentine (14) on a flat, rigid panel (11) made of aluminium with an anodized layer (12).

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Electrical heating device.

Innumerable means exist for generating heat by electric current.

These means are based on the use of highly resistant materials which reach high temperatures when electric current is passed through them thereby creating a great concentration of heat.

The temperatures so reached are nearly always much greater than those actually needed at the point of use.

10 Costly and complex heat diffusers are therefore required involving very considerable differences of temperature. The high temperatures in the conducting parts necessitate means of support made of special materials, such as ceramic and the like, as well as complex but fragile insulating and covering structures.

15 Such high temperatures rapidly wear out the apparatus while the level of efficiency compared with a direct use of fuel is very low.

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When allowance is also made for the considerable expense of highly resistant materials it follows that high costs are incurred in purchasing and operating a heating system. Purpose of the present invention is to transform electric 5 energy into heat by means of simple and practical structures and also to reduce manufacturing and running costs as will be explained below.

Subject of the invention is an apparatus consisting of one or more continuous strips of conductive material, especially copper, of constant width, their thickness being 10 measurable in microns, with a high ratio between width and thickness, laid in lengths side by side with enough space between them for electrical insulation.

Said strips are joined to two contacts that can be connected to a source of electricity, such as a main network. 15 The strips may be laid in the form of a serpentine or spirally or in some other way according to preference. Said strips can be produced by electroplating or can consist of thin metal sheets cut into strips and laid substantially parallel to allow space for insulation.

Preferably the strips are laid on a panel of insulating or conducting material. In the latter case the panel is 20 coated with an insulating layer.

In a preferred type the panel is made of anodized aluminum.

The panel may be flat or curved, rigid or flexible. It may be fitted with means for fixing it to the surface of surrounding structures such as walls and ceilings. The strips can be submerged in the structure of the building.

30 Advantages are gained if the ratio between the overall diffusing surface of the strips of conductive material and the power of electric current can be calculated so as to

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maintain maximum temperature of the strips to make possible the use of supporting and coating materials which have low temperatures of combustion such as wood, cloth, paper, plastic material and others.

The invention offers evident advantages.

5 Heating commences almost immediately, uniform heat being given off by the surfaces created in the above manner.

The cost of the heating body is much less than that of other kinds of heaters at present in use.

10 There is no need for a heat diffuser, normally essential, as heat is produced, emitted and spread by a single body.

The source of heat is easily created whether this is a sheet cut in strips, bands of metal or made by electro-plating.

15 Heating bodies may even be placed in direct contact with the structure to be heated, therefore requiring no thermal chain.

In types that utilize transformed current with an increase in intensity, the lower voltage makes for greater safety.

20 The use of supporting and coating materials such as wood, cloth, paper, plastic material offers exceptional advantages as regards costs, variety of uses and the practical and aesthetic effects obtainable.

Characteristics and purposes of the invention will be 25 made still clearer by the following examples of its execution illustrated by diagrammatically drawn figures.

Fig.1 Radiator consisting of a flat panel with a serpentinewise conductor, front view.

Fig.2 The same as Fig.1 seen from the side.

30 Fig.3 The same radiator when finished with a decorative covering.

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Fig.4 Panel-type radiator with a spiral conductor, front view.

Fig.5 The same as Fig. 4 seen from the side.

The radiator 10 contains a panel 11 of aluminium with an 5 anodized layer 12. The copper strip 13 of constant thickness and width, is laid on said layer.

Thickness is measurable in microns.

Said strip forms the serpentine 14 whose lengths are placed side by side and separated by a space 15 equivalent to 10 that required for electrical insulation.

The ends 16 and 17 of the serpentine are connected to the contacts 18 and 19 and through them to the main electricity network by means of wiring 35 and a plug 36.

On closing the circuit electric current in the serpentine 15 is transformed into heat but avoiding the concentration that would produce very high temperatures.

The large surface area spreads warmth throughout the environment without any necessity for a heat diffuser.

Fig. 3 illustrates how the panel can be finished with a cloth covering 40.

Figures 4 and 5 illustrate a different version 20 comprising the aluminium panel 21 and an anodized layer 22. The strip 23 forms the square spiral 24 with its several turns separated one from another by sufficient space 25 for electrical insulation.

The ends 26 and 27 of the spiral are joined to contacts 28 and 29 for connection to the main source of electricity through the wiring 30 and plug 31.

The effects are similar to those obtained with the radiator shown in Figures 1 and 2.

Claims

1. Apparatus (10,20) for transforming electric current into heat and for diffusing it characterized in that it is formed of one or more continuous strips (13,23) of conductive material, of constant width, whose thickness is measureable in microns, with a high ratio between width and thickness, laid in lengths side by side sufficiently spaced one from another for ensuring electrical insulation (15,25) terminating in two contacts (18,19) (28,29) that can be connected up to a source of electric current.
2. Apparatus (10,20) as in claim 1, characterized in that the strips (13,23) are of copper.
3. Apparatus (10,) as in claim 1, characterized in that the strips (13) are laid in the form of a serpentine (14).
4. Apparatus (20) as in claim 1, characterized in that the strips (23) are laid in the form of a spiral (24).
5. Apparatus (10,20) as in claim 1, characterized in that the strips (13,23) are obtained by electroplating.
6. Apparatus (10) as in claim 1, characterized in that the strips (13) are cut from thin metal sheets laid substantially parallel in such a way that spaces (15) for electrical insulation are created between one strip and another.
7. Apparatus (10,20) as in claim 1, characterized in that the strips (13,27) are supported by a panel (11).
8. Apparatus (10,20) as in claim 7, characterized in that the panel (11) is of metal coated

with a layer (12) of insulating material.

9. Apparatus (10,20) as in claim 7,

characterized in that the panel (11,21) is made of anodized aluminium.

5 10. Apparatus as in claim 7,

characterized in that the panel is made of insulating material.

11. Apparatus (10,20) as in claim 7,

characterized in that the panel (11,21) is flat.

10 12. Apparatus as in claim 7

characterized in that the panel is curved.

13. Apparatus as in claim 7

characterized in that the panel (11,21) may be rigid or flexible as the case requires.

15 14. Apparatus (10,20) as in claim 7

characterized in that the panel (11,21) has means for fixing it to the surfaces of environmental structures such as walls and ceilings.

15. Apparatus as in claim 1,

20 characterized in that the strips (13,27) are submerged in the structure of the building.

16. Apparatus (10) as in claim 1,

characterized in that the ratio between the total diffusing surface of the strips (13) of conductive material and the power of electric current is calculated so as to maintain maximum temperature of the strips (13) at a level that will also permit the use of supporting and coating materials (40) combustion of which takes place at low temperatures such as wood, cloth paper, plastic material and others with consequent advantages as regards costs, variety of uses and in the practical and aesthetic effects obtainable.

1 / 2

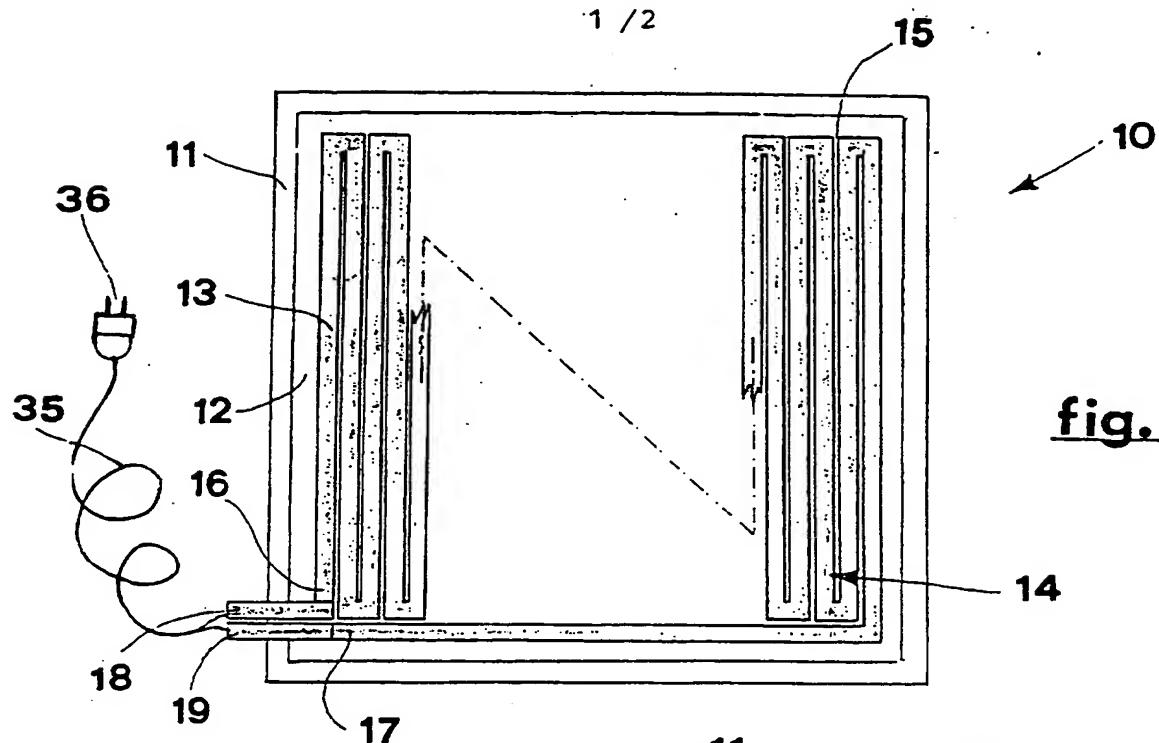


fig. 1

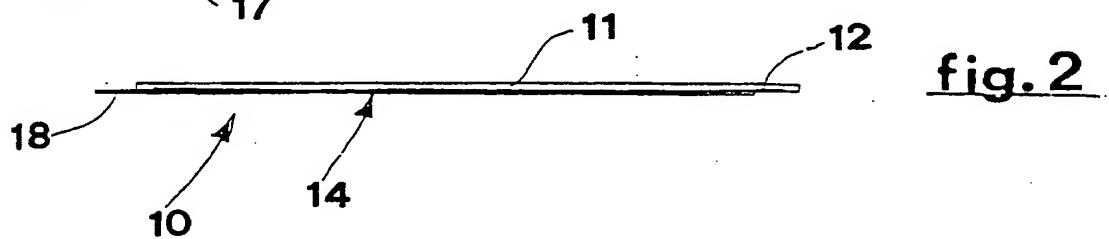


fig. 2

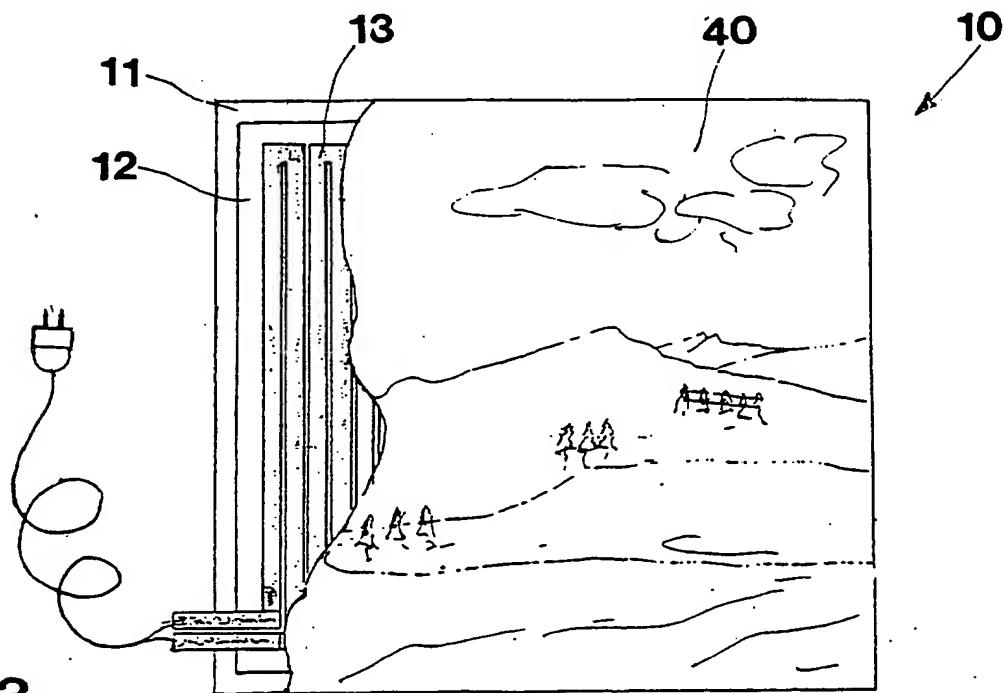


fig. 3

2/2

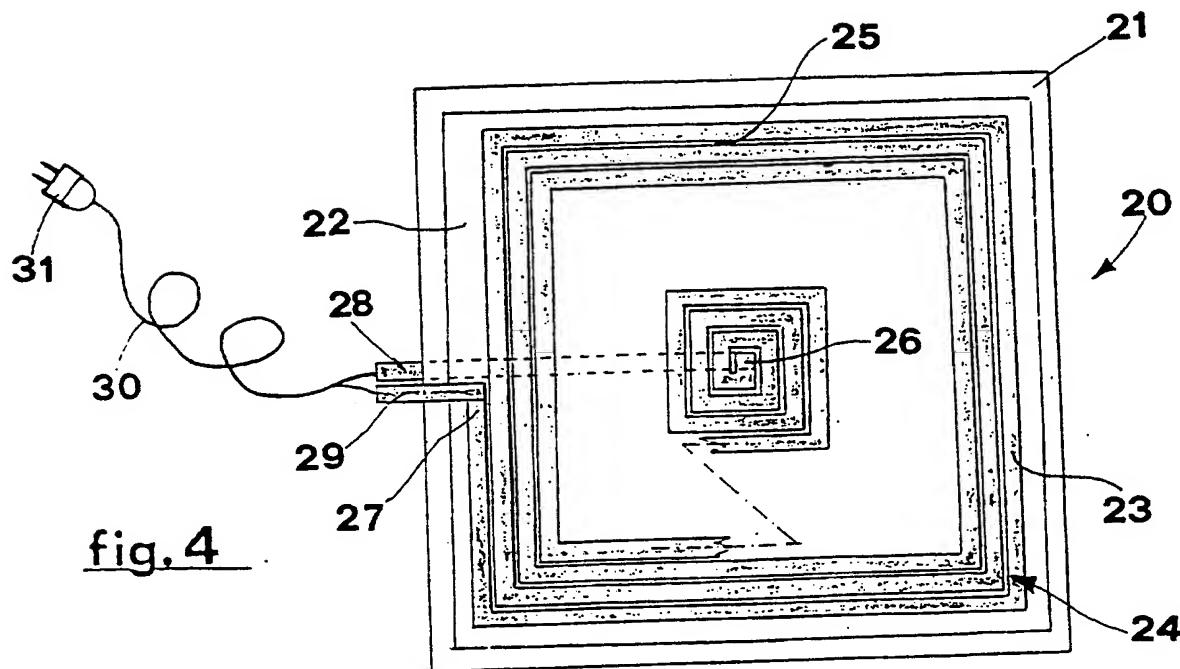


fig. 4

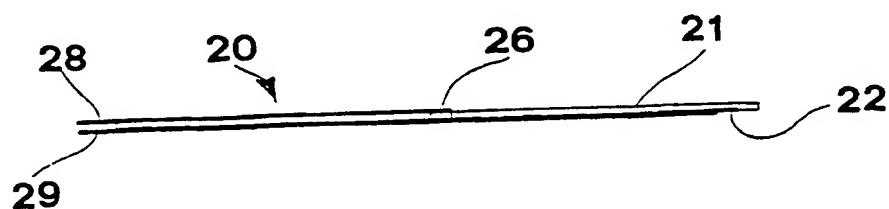


fig. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IT 94/00168

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H05B 3/20, F24D 13/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H05B, F24D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
| X | DE, A1, 2512297 (PRIVAS, YVES), 25 Sept 1975 (25.09.75), page 3, line 23 - page 5, line 7, figures 1-3, claims 1,7 -- | 1-3,7,10-13, 16 |
| X | DE, A1, 2534813 (BRAUN AG), 10 February 1977 (10.02.77), page 3, line 5 - line 19, figure 1 -- | 1,5,7 |
| X | FR, A, 1138132 (SOCIÉTÉ ANONYME DES MANUFACTURES DES GLACES ET PRODUITS CHIMIQUES DE SAINT-GOBAIN, CHAUNY & CIREY), 11 June 1957 (11.06.57), page 1, column 1, line 1 - page 2, column 2, line 6, figures 1-2 -- | 1,4,7 |

 Further documents are listed in the continuation of Box C. See patent family annex.

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- "P" document published prior to the international filing date but later than the priority date claimed

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- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search

14 December 1994

Date of mailing of the international search report

07.04.95

Name and mailing address of the International Searching Authority/Authorized officer



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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-------------------------|
| X | US, A, 3214565 (N.E. HAGER, JR., ET AL), 26 October 1965 (26.10.65), column 3, line 14 - column 4, line 32, figures 1-4 -- | 1-3,6-7, 10-11,13-16 |
| X | US, A, 3805023 (WAINER ET AL.), 16 April 1974 (16.04.74), column 6, line 22 - column 14, line 18, figures 1-10, abstract -- | 1,5,7-9,11 |
| X | US, A, 4650960 (BERGERSEN), 17 March 1987 (17.03.87), column 1, line 6 - column 3, line 46, figures 1-13, abstract -- | 1,13,15 |

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IT 94/00168

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet.

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IT 94/00168

- I Claims 1-2
- II Claims 1,3
- III Claims 1,4
- IV Claims 1,5
- V Claims 1,6
- VI Claims 1,7-14
- VII Claims 1,15
- VIII Claims 1,16

The feature common to all of claims 1 to 16 is the feature of claim 1.

However, the search has revealed that this feature is not novel since it is disclosed in document DE,A1, 2 512 297 (PRIVAS, YVES) 25 September 1975 (25.09.75), claims 1 and 7, figures 1-2, page 3, line 23 - page 5, line 7.

Consequently, the common feature is not a special technical feature within the meaning of PCT Rule 13.2, second sentence, since it makes no contribution over the prior art.

Further, there is no other feature common to all the claims. Since there exists no other common feature which can be considered as a special technical feature within the meaning of PCT Rule 13.2, second sentence, no technical relationship within the meaning of PCT Rule 13 between the different inventions can be seen.

Consequently, it appears that, a posteriori, claims 1 to 16 do not satisfy the requirement of unity of invention.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IT 94/00168

| Patent document cited in search report | Publication date | Patent family member(s) | | Publication date |
|--|------------------|-------------------------|--------------------|----------------------|
| DE-A1- 2512297 | 25/09/75 | BE-A- | 826929 | 16/07/75 |
| | | FR-A,B- | 2265243 | 17/10/75 |
| | | NL-A- | 7503262 | 23/09/75 |
| | | SE-A- | 7503198 | 22/09/75 |
| DE-A1- 2534813 | 10/02/77 | NONE | | |
| FR-A- 1138132 | 11/06/57 | NONE | | |
| US-A- 3214565 | 26/10/65 | NONE | | |
| US-A- 3805023 | 16/04/74 | US-A- | 3763004 | 02/10/73 |
| US-A- 4650960 | 17/03/87 | CA-A- EP-A,B- | 1246651 0171828 | 13/12/88 19/02/86 |

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